Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 14 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

Remarks

I.   Status of claims

Claims 1-55 are pending.

II.   Claim rejections under 35 U.S.C. § 101

The Examiner has rejected claims 28-55 under 35 U.S.C. § 101.

Independent claims 28 and 42 have been amended in ways that address the Examiner's concerns in this regard.

The rejections of claims 28-55 under 35 U.S.C. § 101 now should be withdrawn.

III.   Claim rejections under 35 U.S.C. § 103

A.   Applicable standards for sustaining a rejection under 35 U.S.C. § 103(a)

"A patent may not be obtained ... if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. §103(a).

In an appeal involving a rejection under 35 U.S.C. § 103, an examiner bears the initial burden of establishing *prima facie* obviousness. See In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). To support a *prima facie* conclusion of obviousness, the prior art must disclose or suggest all the limitations of the claimed invention.[1] See In re Lowry, 32 F.3d 1579, 1582, 32 USPQ2d 1 031, 1034 (Fed. Cir. 1994). If the examiner has established a

---

[1] The U.S. Patent and Trademark Office has set forth the following definition of the requirements for establishing a *prima facie* case of unpatentability (37 CFR § 1.56(b)(ii):

> A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 15 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

prima facie case of obviousness, the burden of going forward then shifts to the applicant to overcome the *prima facie* case with argument and/or evidence. Obviousness, is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. This inquiry requires (a) determining the scope and contents of the prior art; (b) ascertaining the differences between the prior art and the claims in issue; (c) resolving the level of ordinary skill in the pertinent art; and (d) evaluating evidence of secondary consideration. See KSR Int'l Co. v. Teleflex Inc., No. 04-1350, slip op. at 2 (U.S. Apr. 30, 2007) (citing Graham v. John Deere, 383 U.S. I, 17-18, 148 USPQ 459, 467 (1966)). If all claim limitations are found in a number of prior art references, the fact finder must determine whether there was an apparent reason to combine the known elements in the fashion claimed. See KSR, slip op. at 14. This analysis should be made explicit. KSR, slip op at 14 (citing In re Kahn, 441 F. 3d 977, 988 (CA Fed. 2006): "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness").

B.   Claims 1-3, 11, 16, 17, 28, 29, 32, 37, 42, 43, 46, and 51

The Examiner has rejected claims 1-3, 11, 16, 17, 28, 29, 32, 37, 42, 43, 46, and 51 under 35 U.S.C. § 103(a) over Schulz ("Subpixel Motion Estimation for Super-Resolution Image Sequence Enhancement") in view of Paniconi (U.S. 7,088,773).

1.   Independent claim 1

Independent claim 1 recites:

> 1.   A machine-implemented image processing method, comprising:
>
> computing a respective motion map for each pairing of a reference image and a respective image neighboring the reference image in a sequence of base images, each motion map comprising a set of motion vectors mapping reference image pixels to respective neighboring image pixels;
>
> assigning respective regions of a target image to motion classes based on the computed motion maps, the target image having a target resolution level and the base images having a base

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 16 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

> resolution level equal to or lower than the target resolution level; and

> computing pixel values for the target image based on corresponding pixel value contributions from the base images selected in accordance with the motion classes assigned to the target image regions.

The rejection of claim 1 under 35 U.S.C. § 103(a) over Schultz in view of Paniconi should be withdrawn because Schultz and Paniconi, taken either alone or in any permissible combination, do not disclose or suggest all the limitations of the claimed invention. The rejection of claim 1 also should be withdrawn because at the time the invention was made there was no apparent reason to combine the teachings of Schultz and Paniconi in the fashion claimed.

The rejection of independent claim 1 is premised on the combined teachings of Schultz and Paniconi. In particular, the Examiner has relied on the following teachings of Schultz:

> ... Schultz discloses computing a respective motion map for each pairing of a reference image and a respective image neighboring the reference image in a sequence of base images, each motion map comprising a set of motion vectors mapping reference image pixels to respective neighboring image pixels (page 38, motion vectors are estimated between video frames, where the accuracy of the estimated motion fields has a direct influence on the quality of the high resolution video still image);

> Schultz discloses the target image having a target resolution level and the base images having a base resolution level equal to or lower than the target resolution level (abstract, a high resolution video still image is estimated from several low resolution frames); and

> Schultz discloses computing pixel values for the target image based on corresponding pixel value contributions from the base images (see for example the Bayesian multiframe resolution enhancement discussed in section 2).

Thus, the Examiner implicitly has acknowledged that Schultz does not disclose or suggest either:

1. assigning respective regions of a target image to motion classes based on the computed motion maps; or

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 17 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

2. computing pixel values for the target image based on corresponding pixel value contributions from the base images <u>selected in accordance with the motion classes assigned to the target image regions.</u>

The Examiner has relied on the following teachings of Paniconi in an effort to make-up for the failure of Schultz' teachings:

> Paniconi discloses assigning respective regions of a target image to motion classes based on the computed motion maps and computing pixel values for the target image based on corresponding pixel value contributions from the base images selected in accordance with the motion classes assigned to the target image regions (column 2 lines 39-49, methods for motion segmentation can divide a frame into a number of motion classes, where each moving object is assigned to its own motion class).

Contrary to the Examiner's position, however, Paniconi does not disclose "assigning respective regions of a target image to motion classes based on the computed motion maps" nor does Paniconi disclose "computing pixel values for the target image based on corresponding pixel value contributions from the base images selected in accordance with the motion classes assigned to the target image regions."

In col. 2, lines 39-49, Paniconi teaches:

> FIG. 1a illustrates a frame having objects according to one embodiment. Methods for motion segmentation can divide a frame containing an image in a video sequence into a number of classes. For example, frame 102 has three moving objects, object 104, object 106, and object 108. An encoder could assign the region defining each moving object 104, 106, and 108 to its own class. The class can then be tracked from frame to frame using vectors rather than encoding the entire object in each frame. In this way, a great deal of processing and data storage can be saved because the object need only be encoded.

Contrary to the Examiner's position, the mere teaching that "methods for motion segmentation can divide a frame into a number of motion classes, where each moving object is assigned to its own motion class" does not constitute a teaching of either:

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 18 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

1.   assigning respective regions of a target image to motion classes based on the computed motion maps; or

2.   computing pixel values for the target image based on corresponding pixel value contributions from the base images <u>selected in accordance with the motion classes assigned to the target image regions.</u>

For example, the cited teaching does not disclose or suggest anything whatsoever about a target image with pixel values computed based on corresponding pixel value contributions from base images in a sequence, much less anything whatsoever about such a target image in which the pixel value contributions from the base images are selected in accordance with the motion classes assigned to the target image regions. The video frames described in the cited disclosure are original low-resolution video frames whose pixel values are not computed based on corresponding pixel value contributions from base images in a sequence.

Thus, the Examiner has not established a *prima facie* case that claim 1 is obviousness under 35 U.S.C. § 103(a) because, on its face, the Examiner has not established that the proposed combination of Schultz and Paniconi includes all the elements of the invention defined in claim 1. The Examiner has acknowledged that Schultz does not disclose or suggest any of the following elements of claim 1: assigning respective regions of a target image to motion classes based on the computed motion maps; and computing pixel values for the target image based on corresponding pixel value contributions from the base images <u>selected in accordance with the motion classes assigned to the target image regions</u>. The Examiner, however, has not shown that Paniconi's discloses or suggests either of these elements of claim 1.

For at least these reasons, the rejection of claim 1 under 35 U.S.C. § 103(a) over Schultz and Paniconi should be withdrawn.

The rejection of claim 1 under 35 U.S.C. § 103(a) over Schultz and Paniconi also should be withdrawn because at the time the invention was made there was no apparent reason to combine the teachings of Schultz and Paniconi in the fashion claimed in claim 1.

Schultz discloses a method for determining a high-resolution video still image from low-resolution video frames. In accordance with this method, two successive low-resolution video frames are up-sampled to the high-resolution level and subpixel-resolution motion vectors are estimated from the up-sampled frames (see section 3, first paragraph). The estimated subpixel-

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 19 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

resolution motion vectors are down-sampled to obtain a single subpixel-resolution motion vector estimate for each pixel in the low-resolution video frames (see section 3, first paragraph). Inaccurate motion estimates are detected and eliminated (see section 3.4). The remaining subpixel-resolution motion vectors are used to determine the pixel values of the high-resolution video still image (see section 2).

Paniconi discloses a motion segmentation method that involves determining motion vectors between low-resolution video frames (see col. 3, lines 31-53), classifying motion vectors of pixels in low-resolution video frames (see col. 3, line 54 - col. 4, line 21), and enhancing the motion classification results (see col. 4, line 22 - col. 7, line 29). The final motion classification results are used by a video encoder to encode digital video (see col. 1, line 60 - col. 2, line 11).

The Examiner has asserted that "It would have been obvious to one of ordinary skill in the art to include the motion classes of Paniconi with the super resolution enhancement algorithm of Schultz, because each class can be tracked across frames using vectors, which saves processing time as taught by Paniconi." Contrary to the Examiner's statement, however, one skilled in the art would have had any apparent reason to "include the motion classes of Paniconi with the super resolution enhancement algorithm of Schultz" because neither Schultz nor Paniconi discloses or suggests how such a modification of Schultz' teachings would have served any useful purpose whatsoever. For example, although it is possible to classify the low-resolution video frames disclosed in Schultz using the motion classification process disclosed in Schultz, neither Schultz nor Paniconi discloses or suggests how the results of such motion classification would serve any useful purpose in the context of Schultz' super-resolution image enhancement process. Moreover, neither Schultz nor Paniconi even hints that such motion classification results might be used in determining the pixel values of the high-resolution video still image.

Without any apparent reason for modifying Schultz' disclosure, the Examiner's rationale in support of the rejection of claim 1 amounts to no more than a conclusory statement which cannot support a rejection under 35 U.S.C. § 103. See KSR Int'l Co. v. Teleflex Inc., No. 04-1350, slip op. at 14 (U.S. Apr. 30, 2007) (citing In re Kahn, 441 F. 3d 977, 988 (CA Fed. 2006): "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements;

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 20 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness").

For at least this additional reason, the rejection of claim 1 under 35 U.S.C. § 103(a) over Schultz and Paniconi should be withdrawn.

2. Claims 2, 3, 11, 16, and 17

Each of claims 2, 3, 11, 16, and 17 incorporates the elements of independent claim 1 and therefore is patentable over Schultz in view of Paniconi for at least the same reasons explained above.

3. Claims 28, 29, 32, 37

Independent claim 28 recites elements that essentially track the pertinent elements of independent claim 1 discussed above. Therefore claim 28 is patentable over Schultz in view of Paniconi for at least the same reasons explained above.

Each of claims 29, 32, and 37 incorporates the elements of independent claim 28 and therefore is patentable over Schultz in view of Paniconi for at least the same reasons.

4. Claims 42, 43, 46, and 51

Independent claim 42 recites elements that essentially track the pertinent elements of independent claim 1 discussed above. Therefore claim 42 is patentable over Schultz in view of Paniconi for at least the same reasons explained above.

Each of claims 43, 46, and 51 incorporates the elements of independent claim 42 and therefore is patentable over Schultz in view of Paniconi for at least the same reasons.

C. Claims 4, 5, 30, and 44

The Examiner has rejected claims 4, 5, 30, and 44 under 35 U.S.C. § 103(a) over Schultz in view of Paniconi and Hanna (U.S. 6,269,175).

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 21 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

Each of claims 4 and 5 incorporates the elements of independent claim 1; claim 5 incorporates the elements of independent claim 28; claim 44 incorporates the elements of independent claim 42.

Hanna does not make-up for the failure of Schultz and Paniconi to disclose or suggest all the elements of any of the independent claims 1, 28, and 42.

Therefore, claims 4, 5, 30, and 44 are patentable over Schultz, Paniconi, and Hanna for at least the same reasons explained above.

D.   Claims 6, 12-15, 31, 33-36, 45, and 47-50

The Examiner has rejected claims 6, 12-15, 31, 33-36, 45, and 47-50 under 35 U.S.C. § 103(a) over Schultz in view of Paniconi and Eren ("Robust, Object-Based High-Resolution Image Reconstruction from Low-Resolution Video").

Each of claims 6 and 12-15 incorporates the elements of independent claim 1; each of claims 31 and 33-36 incorporates the elements of independent claim 28; each of claims 45 and 47-50 incorporates the elements of independent claim 42.

Eren does not make-up for the failure of Schultz and Paniconi to disclose or suggest all the elements of any of the independent claims 1, 28, and 42.

Therefore, claims 6, 12-15, 31, 33-36, 45, and 47-50 are patentable over Schultz, Paniconi, and Eren for at least the same reasons explained above.

E.   Claims 7-10, 18-27, 38-41, and 52-55

The Examiner has rejected claims 7-10, 18-27, 38-41, and 52-55 under 35 U.S.C. § 103(a) over Schultz in view of Paniconi, Eren, and Kondo (U.S. 6,307,560).

Each of claims 7-10 and 18-27 incorporates the elements of independent claim 1; each of claims 38-41 incorporates the elements of independent claim 28; each of claims 52-55 incorporates the elements of independent claim 42.

Neither Eren nor Kondo makes-up for the failure of Schultz and Paniconi to disclose or suggest all the elements of any of the independent claims 1, 28, and 42.

Therefore, claims 7-10, 18-27, 38-41, and 52-55 are patentable over Schultz, Paniconi, Eren, and Kondo for at least the same reasons explained above.

Applicant : Mei Chen
Serial No. : 10/824,692
Filed : April 15, 2004
Page : 22 of 22

Attorney's Docket No.: 200310075-1
Amendment dated Oct. 22, 2007
Reply to Office action dated June 22, 2007

IV.   Conclusion

For the reasons explained above, all of the pending claims are now in condition for allowance and should be allowed.

Charge any excess fees or apply any credits to Deposit Account No. 08-2025.

Respectfully submitted,

Date: October 22, 2007

Edouard Garcia
Reg. No. 38,461
Telephone No.: (650) 289-0904

Please direct all correspondence to:

Hewlett-Packard Company
Intellectual Property Administration
Legal Department, M/S 35
P.O. Box 272400
Fort Collins, CO 80528-9599